Jan. 24, 1956 E. H. KENDALL 2,731,859

PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

Filed March 31, 1951

6 Sheets-Sheet 1

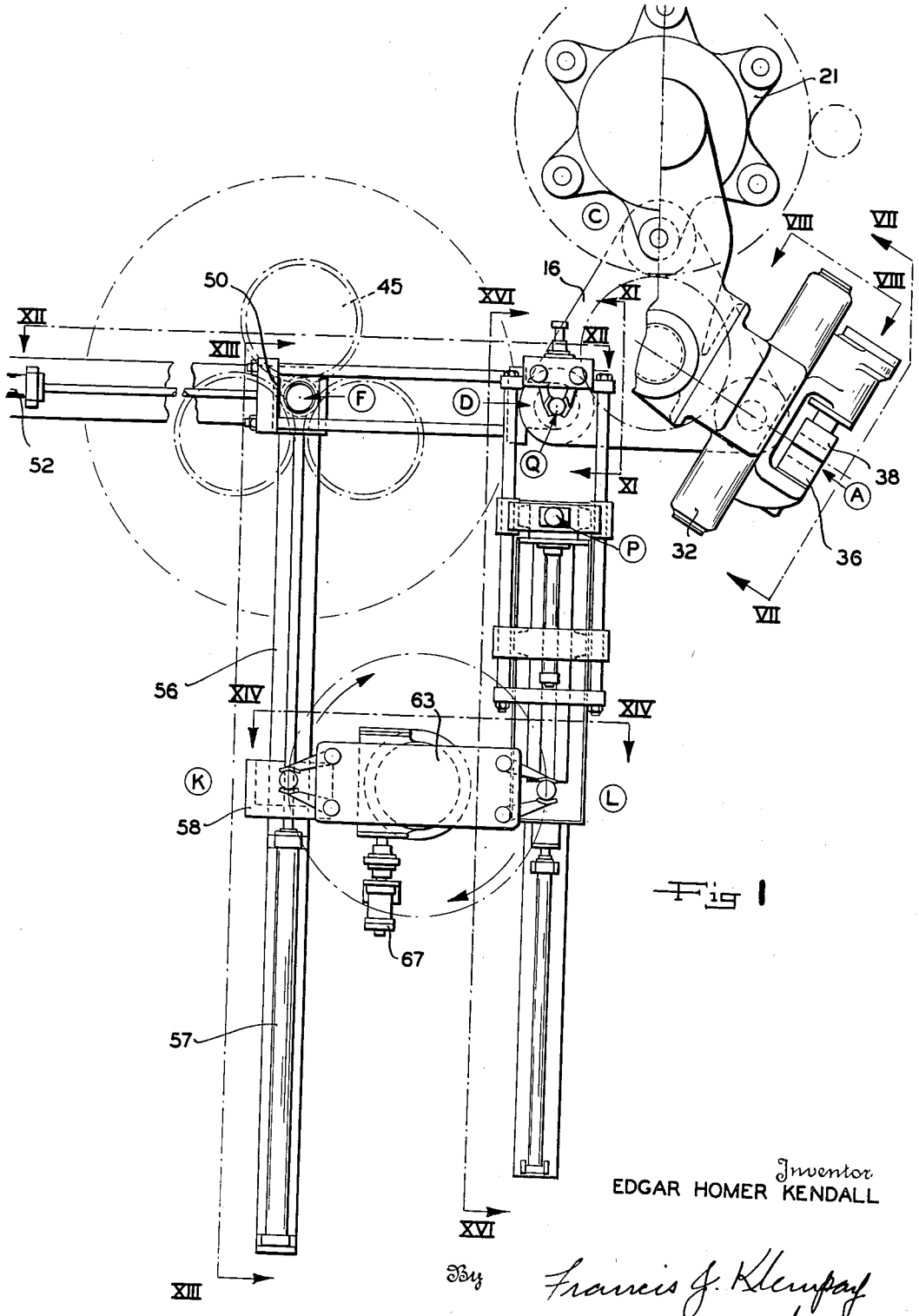


Fig 1

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6 Sheets-Sheet 2

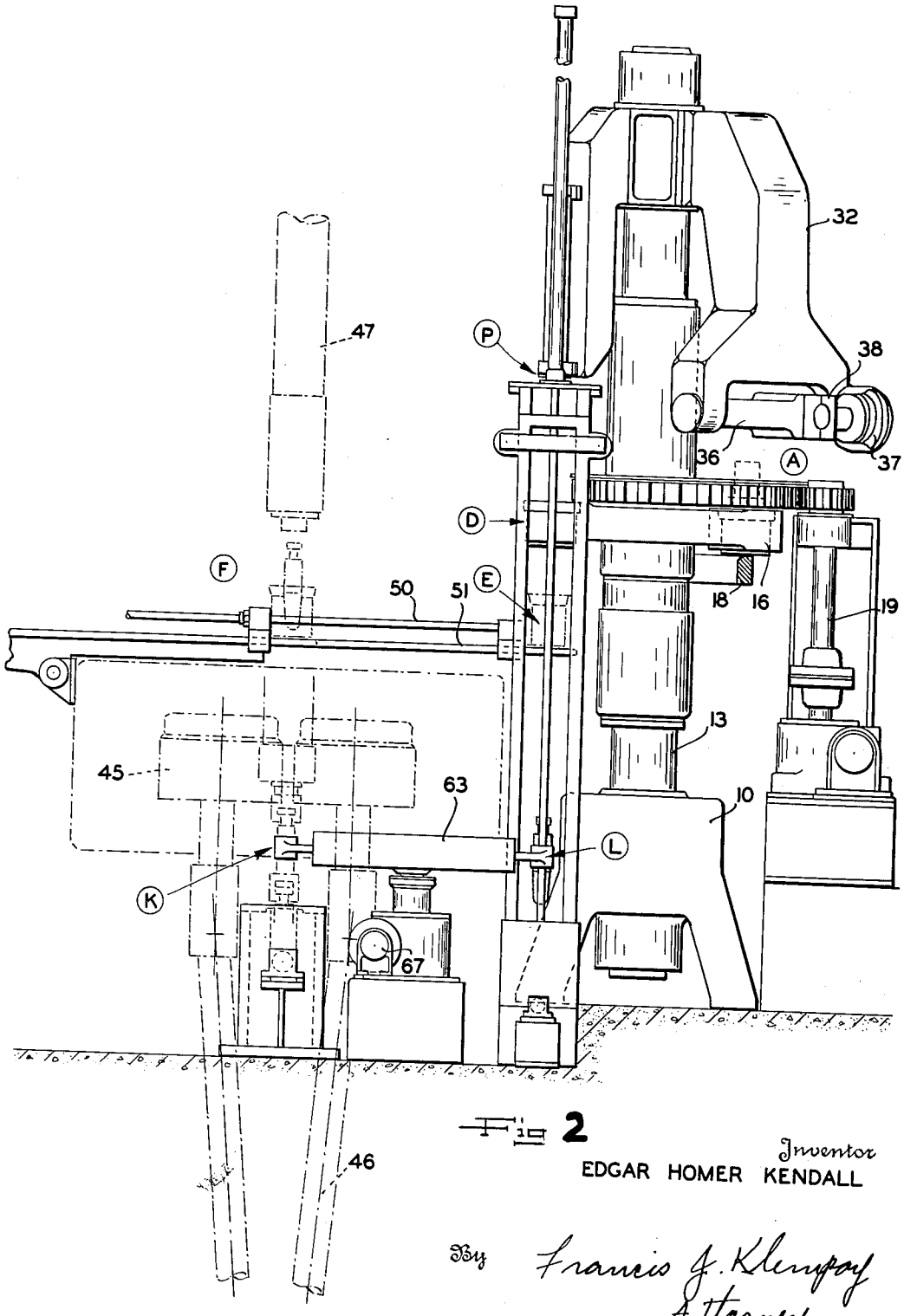


Fig. 2

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PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

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6 Sheets-Sheet 3

Fig 7

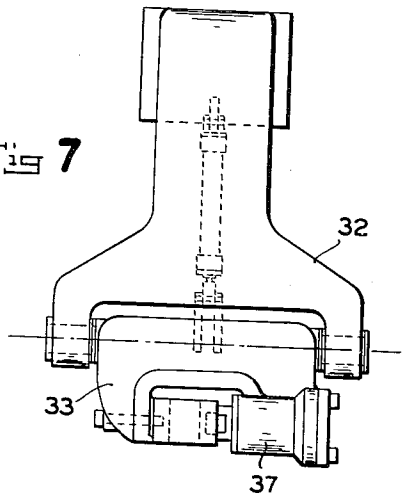
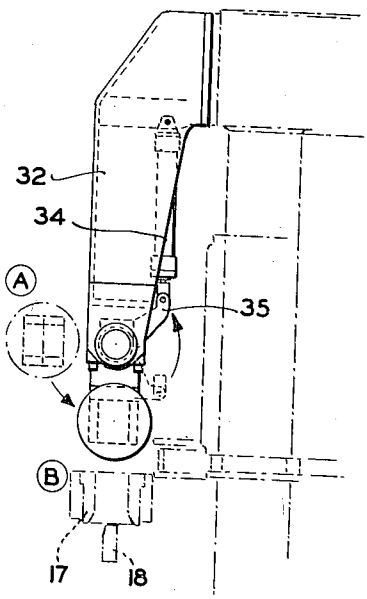


Fig 8



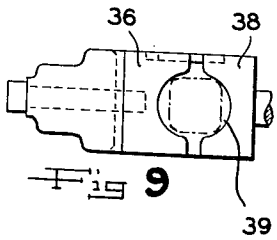


Fig 9

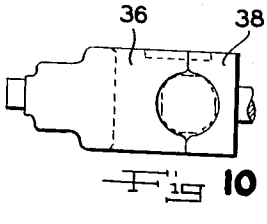


Fig 10

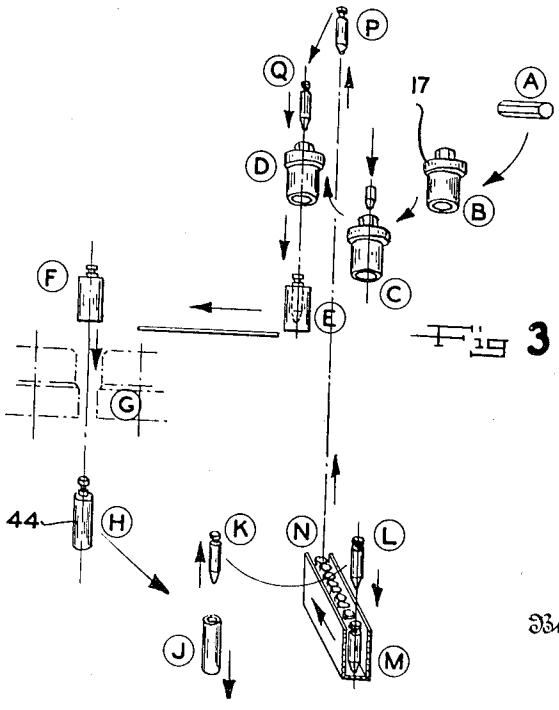


Fig 3

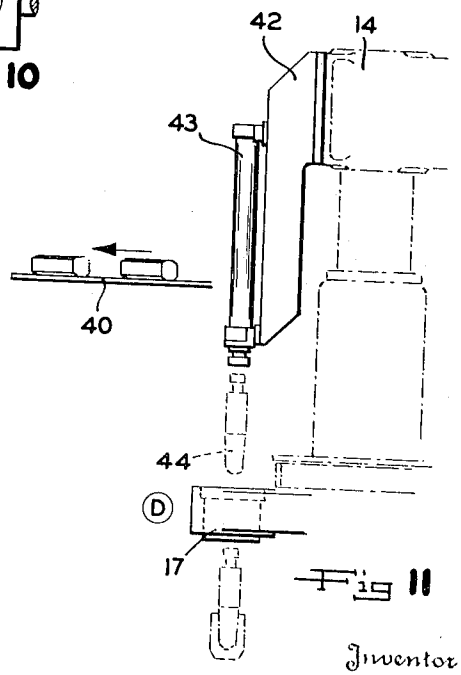


Fig 11

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PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

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6 Sheets-Sheet 4

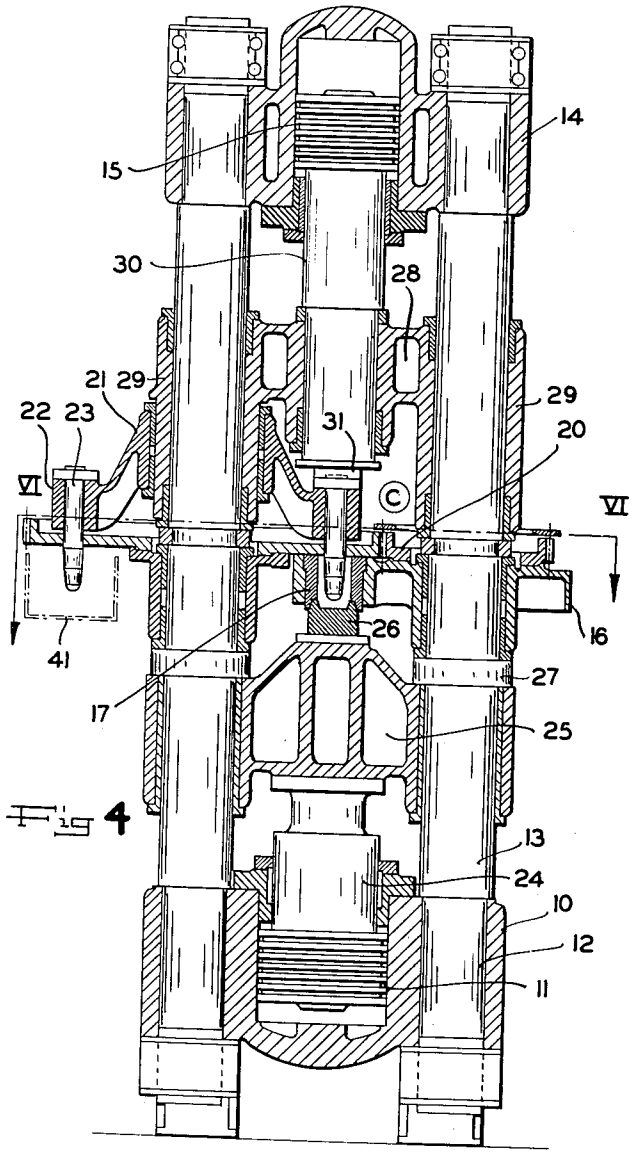


Fig 4

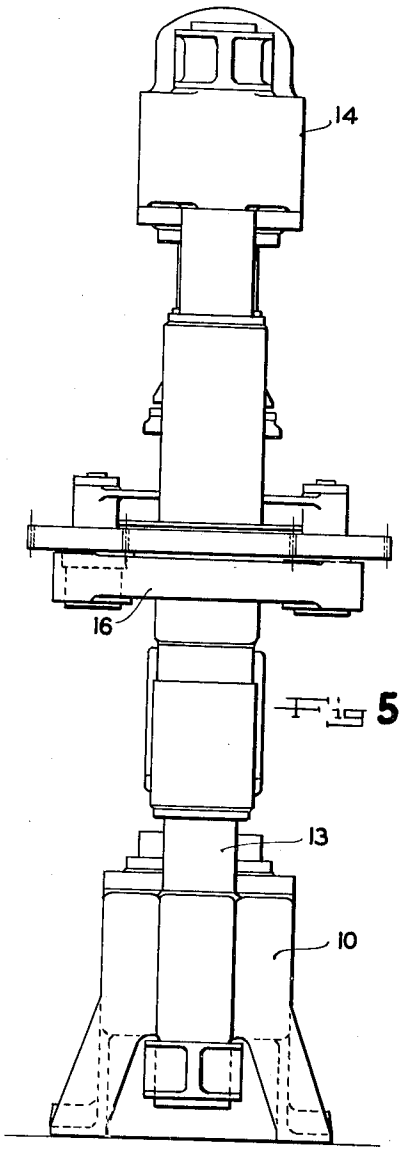


Fig 5

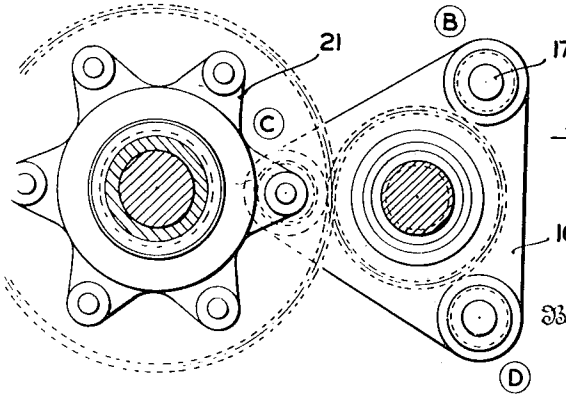


Fig 6

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PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

Filed March 31, 1951

6 Sheets-Sheet 5

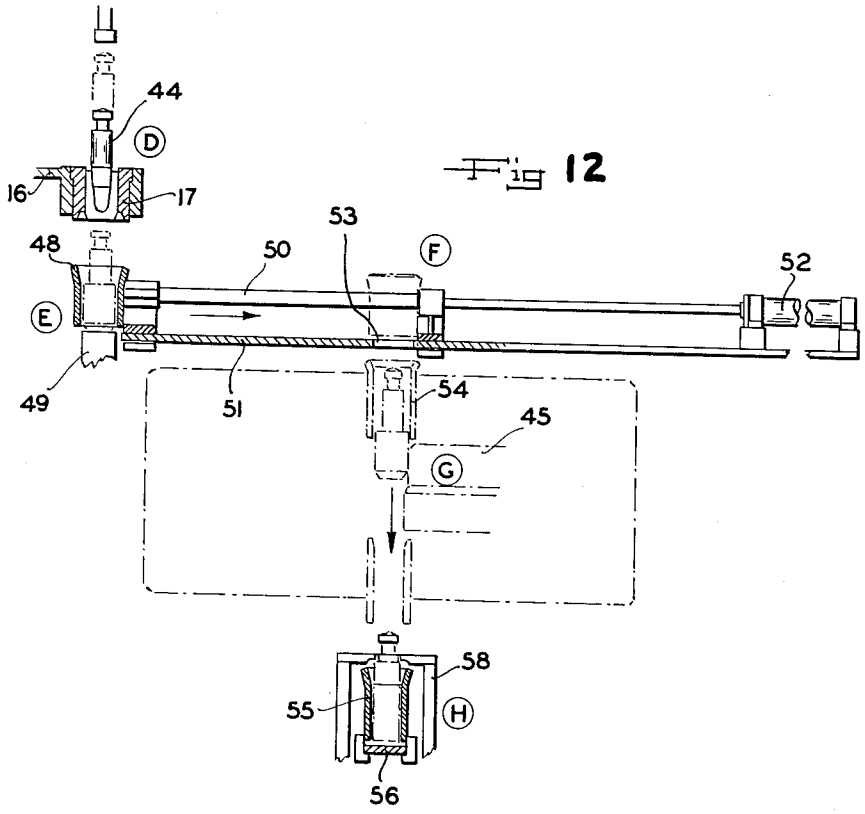


Fig 12

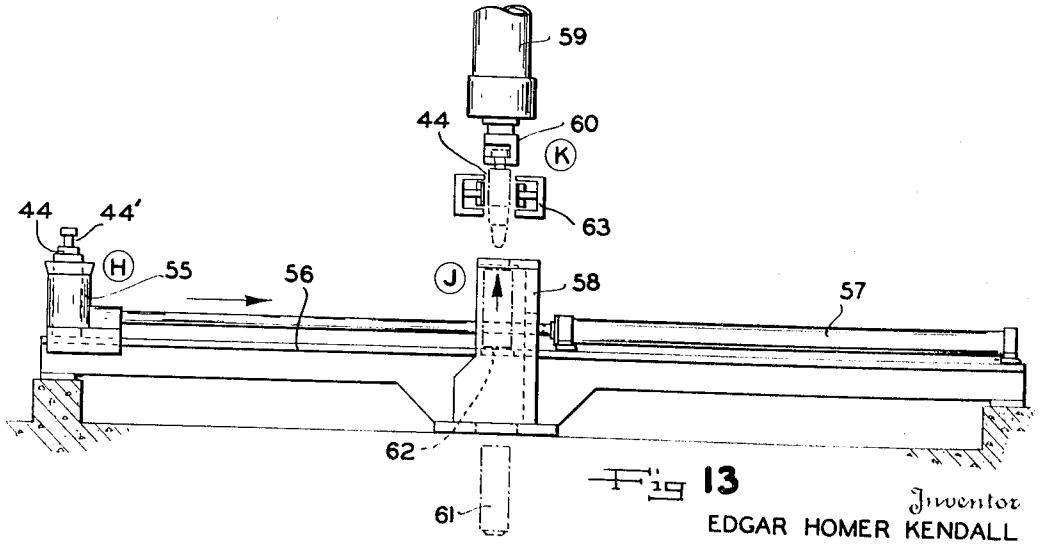


Fig 13

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PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

Filed March 31, 1951

6 Sheets-Sheet 6

Fig 17

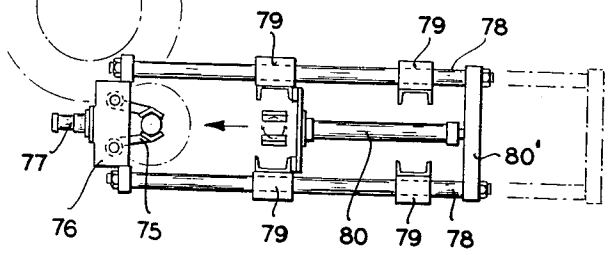
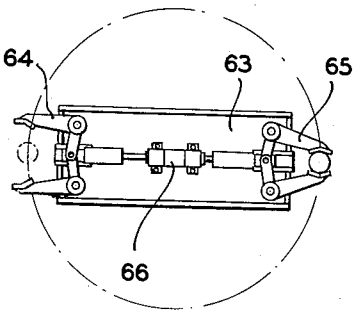
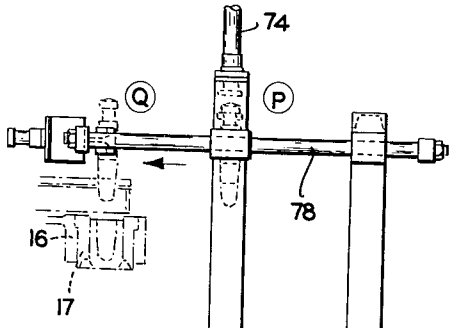


Fig 15





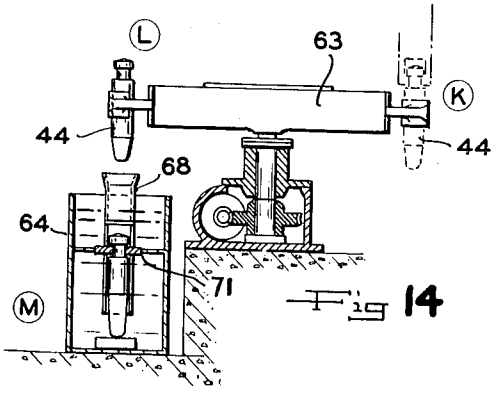


Fig 14

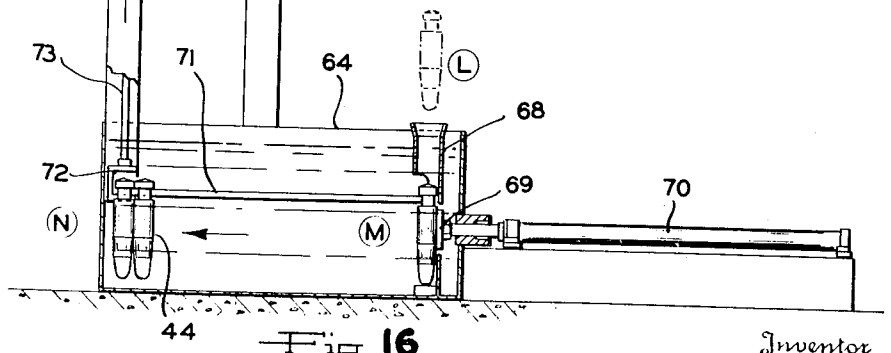


Fig 16

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United States Patent Office 2,731,859
Patented Jan. 24, 1956

2,731,859

PRODUCTION APPARATUS FOR SHELL CASINGS AND THE LIKE

Edgar Homer Kendall, Alliance, Ohio, assignor, by mesne assignments, to Salem-Brosius, Inc., a corporation of Pennsylvania

Application March 31, 1951, Serial No. 216,685

7 Claims. (Cl. 78—9)

This invention relates to apparatus for producing shell casings and the like and more particularly to improved apparatus for automatically converting a raw metal blank or billet into a forged and rolled article such as a shell casing, for example. The invention resides in the provision, in such apparatus, of improved method and apparatus for conditioning the initially heated blank or billet, and for progressing the same through a forging press and a rolling mill in sequence and the primary object of the invention is the provision of assembled apparatus for this purpose whereby shell casings and the like may be manufactured economically in large quantities and to predetermined standards of quality.

A further and more specific object of the invention is the provision, in assembled apparatus for the purpose specified, of an improved mechanism for receiving an initially heated blank or billet and for thereafter automatically conditioning the same and feeding the same to a metal forging press.

Another more specific object of the invention is the provision of improved arrangements for handling the billets or blanks in their progression through the forging press and through the rolling mill required in the process of making the shell casings and the like, including the provision of inserting and retaining an internal sizing mandrel in each of the pieces being worked whereby the mandrels progress with the work pieces through the rolling mill and are thereafter stripped from the work pieces and automatically returned to a press loading station for reuse in incoming blanks. The recirculatory path of movement imparted to the mandrels includes a cooling bath and the handling of the mandrels is automatic as is also the operation of the press and mill so that the whole assembly provides a most effective unit for the high speed production of shell casings, for example.

A still further object of the invention is the provision, in automatic apparatus for producing shell casings and the like by the hot forging and rolling process, of an improved mandrel for individual application to each of the work pieces whereby the mandrels and/or the assembled mandrels and work pieces can be more expeditiously handled by the use of automatic equipment than has been heretofore suggested in any apparatus for comparable purposes. Also, the invention provides dependable and rapid-acting transfer of mechanisms for moving the mandrels and/or assembled mandrels and work pieces through the various stations of the closed circuit of travel of the mandrels.

Yet another object of the invention is the provision of an improved arrangement for operating a forging press and for transferring hot forged articles therefrom to an adjacent rolling mill whereby the progression of the initially heated blanks or billets through the press and mill is at such rate that the further heating of the work pieces intermediate any of the steps of the forming process is unnecessary. This not only reduces the cost of manufacture but also increases the productivity of the plant

installation and reduces the loss of metal through oxidation.

The above and other objects and advantages of the invention will become apparent upon consideration of the following detailed specification and the accompanying drawing wherein there is disclosed a preferred embodiment of the invention.

In the drawing:

Figure 1 is a plan view of a plant installation for producing shell casings and the like and utilizing the principles of my invention;

Figure 2 is a side elevation of a press and a portion of the transfer mechanism utilized in the assembly of Figure 1;

Figure 3 is a schematic representation showing the progression of the work pieces, forging dies and mandrels through the plant of our invention;

Figures 4, 5 and 6 are vertical sectional, side elevational, and horizontal sectional views, respectively, of the forging press utilized in plant of Figure 1;

Figures 7 and 8 are front and side views, respectively, of a combined billet conditioning and loading fixture utilized on the press of the plant of Figure 1;

Figures 9 and 10 show the forming jaws of the billet conditioning apparatus of Figures 7 and 8 in open and closed positions, respectively;

Figure 11 is a schematic showing of the press discharge station where the press-formed work piece is supplied with an internal rolling mandrel and is ejected from the turret holder of the press;

Figures 12, 13 and 14 are partial elevations viewed from the lines XII—XII, XIII—XIII and XIV—XIV of Figure 1;

Figure 15 is a top view of the apparatus of Figure 14;

Figure 16 is an elevation viewed from the line XVI—XVI of Figure 1;

Figure 17 is a plan view of the apparatus of Figure 16.

In the production of shell casings and similar articles by the use of apparatus of my invention, initially heated billets or blanks which are preferably square in cross section are first subjected to a forging squeeze to bring them more into round shape, after which these blanks are loaded vertically into the dies of a forging press. This initial working is indicated schematically at A in Figure 3 where at B the blank is shown loaded into a forging die. At C the piercing die of the forging press is shown entering the die encased blank, at D the rolling mandrel is being inserted in the forged and pierced blank which at this time remains in the female die of the press. As will appear later downward movement of this last mentioned die is restrained so that continued downward movement of the rolling mandrel ejects the work piece and the rolling mandrel into the open as at E. At F the assembled work piece and rolling mandrel is in position to be fed into the base of the crossed roll or "Assel" mill G from which the completed shell casing emerges at H. At K, J the work piece is stripped from the rolling mandrel which is thereupon moved to position L and then dropped down into a cooling tank at position M. The rolling mandrel then moves laterally through the coolant to position N where an elevator mechanism, to be hereinafter described, raises it to position P preparatory to its insertion in a succeeding forged work piece to be rolled.

To facilitate the loading of the press and the rolling mill, the transfer of the work pieces, and the circulation of the rolling mandrels, as well as to effect economy in plant space and high speed of production I preferably arrange both the forging press and the rolling mill for operation about vertical axes and it should also be noted that this disposition of these principal plant components enables them to be quite closely coupled so that there is a minimum loss of heat from the work pieces

preparatory to the passage of the work pieces through the throat of the rolling mill. This result, together with the fact that the time required to progress the work piece through the press is uniform and automatically determined because of the automatic nature of the plant enables me to adjust the initial heating of the work pieces so that the same always reach the rolling mill at optimum temperature for high speed and quality rolling.

The forging press of my apparatus comprises a large heavy casting **10** which forms the base for the press, and which is provided with a centrally disposed cylinder **11** and two outwardly disposed bores **12** for reception of the lower ends of the tie rods **13**. The upper ends of the rods **13** are received in suitable bores formed in a cross head **14** in which is machined a centrally disposed cylinder **15**. Rotatable on one of the rods **13** (the right rod in Figure 4) is a turreted die holder **16** which has three shouldered apertures to each receive a tubular forging die or ring **17**. As shown more clearly in Figures 3 and 4 the dies **17** are open at their tops and bottoms and to prevent the work pieces from falling through the dies when first loaded I provide a fixed arcuate stop **18** as shown in Figure 2. Turret **16** is arranged to be rotated from one index position to another by a suitable drive mechanism shown schematically at **19** in Figure 2. It will be understood that suitable controls, not shown, will be utilized to effect 120° rotation of the turret **16** during each cycle of operation of the assembled apparatus. Positioned above the turret **16** and spanning the rods **13** is a stripper plate **20** the purpose of which will be later described.

Mounted for rotation about the axis of the other of the rods **13** (the left rod of Figure 4) is a second turret **21** which carries integrally six vertically apertured boxes **22** each of which is adapted to slidably receive, in depending relation, a piercing mandrel **23**. As shown in Figure 4, the mandrels **23** are receivable in the boxes **22** from above and are each provided with an upper flange which limits the downward sliding movement thereof. During normal operation, the mandrels are retained in the turret holder but it should be noted that the arrangement provides for the easy removal and replacement of the mandrels as required. Suitable driving and indexing means, not shown, are provided to rotate the turret **21** in step-by-step manner to present successive mandrels **23** to the incoming work pieces at each cycle of operation of the press.

Received in cylinder **11** of the base **10** is a ram **24** the upper end of which supports a cross head **25** slidably mounted on the rods **13** and supported on the cross head is a formed anvil **26** which fits into the lower end of the die **17** as the same are indexed to central or working position and it will be understood that the anvil **26** forms the lower wall of the female die in which the work piece is formed by the press operation. The anvil is properly positioned vertically by shoulders **27** formed integrally on the rods **13** which limit the upward travel of the slidable cross head **25**. Slidably mounted on the upper end portions of the rods **13** but below the cross head **14** is a cross head **28** which has integral tubular portions **29** encircling the rods **13**. As shown in Figure 4, the turret **21** is rotatably mounted on one of these tubular portions and it should be noted that the turret **21** raises and lowers with the cross head **28**. Movably supporting the cross head **28** is a ram **30** which is received in the cylinder **15** and in the lower central portion of the cross head **28** is a pad **31** which engages the upper end of the particular piercing mandrel **23** which is indexed in operative central position in the press.

Rigidly secured to the upper cross head **14** of the forging press is an outwardly and downwardly extending yoke **32** in which there is mounted for pivotal movement about a horizontal axis a C-shaped clamp **33** with the open legs of the clamp extending either downwardly or outwardly

as evident from Figures 7 and 8. An air or hydraulic cylinder **34** having one end pivoted to the body of the yoke **32** and the other end pivoted to a crank arm **35** on the clamp **33** is provided to rotate the clamp **33** from a vertical or depending position to a horizontal position as shown in Figure 8. Rigidly secured to one leg of the clamp **33** is a die or jaw **36** and mounted on the other leg of the clamp is an air or hydraulic cylinder **37** which mounts on its ram or piston rod a second die or jaw **38** which mates with the jaw **36**. Jaws **36** and **38** are provided with semicylindrical work surfaces **39** which form a generally cylindrically shaped billet-receiving opening and as indicated in Figures 7 and 8 the axis of this opening is in the general plane of the clamp **33**.

The billets to be formed and pierced are first properly heated in a suitable furnace, not shown, and are conveyed to my apparatus longitudinally and along a horizontal path by a suitable conveyor as shown schematically at **40** in Figure 3. The position of this conveyor is such that with the clamp **33** tilted to horizontal position and the jaws **36** and **38** opened a billet may be moved directly into the die opening **39** by the conveyor. When the billet is properly positioned in the jaws **36** and **38** fluid pressure is applied to cylinder **37** to force the jaws together thereby squeezing the heated square billet into substantially cylindrical shape and simultaneously the cylinder **34** is energized to tilt the clamp **33** to vertical position which then positions the billet directly over one of the dies **17** on the turret **16**, it being observed that the parts are so dimensioned and related that the loading station for the die turret **16** is directly below the die openings in the jaws **36** and **38** when the clamp **33** is in vertical position. After this preliminary rounding of the billet the jaws **36** and **38** are opened and the billet falls into the awaiting die **17** preparatory to its transfer to the working station of the press.

While a billet is being thus loaded into one of the three dies **17** another billet is being formed and pierced by downward movement of the ram **30** and simultaneously a third billet is being supplied with the rolling mandrel and ejected from its forging die at an unloading station as will be described later. Under automatic limit switch control, not shown, the head **29** is raised and the head **25** lowered immediately upon completion of the press-forging operation and immediately after the loading of a raw billet and the discharge of a forged billet the turrets **16** and **21** are automatically indexed to bring the raw billet into the center of the press and a succeeding piercing mandrel **23** into operative position above it. Fluid pressure is now admitted to the cylinders **11** and **15** whereupon the anvil **26** closes into proper position in the lower end of the die ring **17** and the pad **31** moves downwardly to force the centrally disposed mandrel **23** into the billet positioned in the die ring therebelow to pierce the billet and cause the metal thereof to flow outwardly into full contact with the surfaces of the die ring **17** and anvil **26** to rough-form the shell casing or other object being produced. It will be understood that the stripper plate **20** is provided with an aperture to receive the centrally disposed mandrel **23** and that upon the upward or return stroke of the cross head **29** and the turret **21** that this mandrel will be withdrawn upwardly while the pierced blank is retained in the die **17** by means of the plate **20**.

It should be noted particularly that the arrangement of the press of my invention is such that the heavy compressive and tensile forces resulting from the piercing and forging operation are symmetrically and centrally disposed and distributed within and between the two tie rods **13**. Thus all eccentric loading is avoided and the press can be constructed with a minimum of weight and section and operated with a minimum of friction and wear.

To enable the press to operate at high productive speeds I have provided the six piercing mandrels **23**, only one of which is in use at each cycle of operation, whereby sufficient time is allotted to the mandrels to cool and

recover between uses and, if required, I may also provide a dip tank **41** for containing a coolant into which the idle piercing mandrels may be dipped as the mandrel turret reciprocates and indexes during repetitive actuation of the press.

Also secured to the upper cross head **14** of the press is a mounting bracket **42** which carries a vertically disposed cylinder **43** which is vertically aligned with the forged billet when positioned at the discharge station of the die turret **16**. I have provided means in the nature of conveyor apparatus to be hereinafter more fully described for supplying rolling mandrels **44** in succession to this discharge station and as explained above at this discharge station such mandrels are inserted in the pierced and forged billets, the mandrels being forced into the billets and the thus assembled billets and mandrels being pushed out of the die ring **17** by the downward actuation of the cylinder **43** as evident from Figures 11 and 12.

Positioned closely adjacent the piercing and forging press is the rolling mill which is of the cross roll type and which is preferably arranged vertically as pointed out above. This mill comprised of the rolls **45**, the drive shafts **46** and the pusher **47** does not, per se, form any part of the present invention and is accordingly shown only in schematic dotted outline. The drive may be positioned either vertically above the roll pass or below the roll pass as shown. Referring now more particularly to Figures 1, 2 and 12 for an understanding of the mechanism used to transfer the assembled pierced billet and rolling mandrel from the forging press to the rolling mill, it will be noted that I have provided a vertically disposed sleeve-like receptacle **48** for the reception of the pierced billets at the discharge station of the press. The receptacle is open at the bottom but to absorb the shock of the falling billet and to limit its downward travel therein I provide a suitable stop member **49**. Receptacle **48** is carried by a frame **50** which is slidably mounted on a plate **51** in which it is arranged to be moved by an elongated air cylinder **52**. As receptacle **48** is moved to the right, as viewed in Figure 12, the contained work piece slides off the stop **49** and onto the plate **51** and moves therealong until it encounters an aperture **53** therein through which it falls into the guide tube **54** normally provided in crossed-roll mills. Immediately upon discharge of the work piece the receptacle **48** is moved back to its initial receiving position but the open nature of the frame **50** allows for the entry of the lower end of the pusher **47** into the guide tube **54** and into contact with the upper end of the lower mandrel **44** whereby the work piece and mandrel may be fed downwardly through the working piece of the mill. Below the mill the ejected rolled piece and mandrel is guided into a receptacle **55** which is slidably mounted on a horizontal disposed track **56** and arranged to move along by an elongated air or hydraulic cylinder **57**. Positioned along the track **56** is a stripper box **58** having side and top walls and a back wall but an open front. There is a slot in the top wall of the box **58** so that the upwardly projecting end of the rolling mandrel **44** may extend up through the top wall while the body of the work piece as well as the container **55** is positioned entirely within the box. For a purpose now to become evident the upper end portion of each of the rolling mandrels is provided with a wide annular groove **44'**.

I provide a mechanism for forcibly withdrawing the rolling mandrel from the rolled piece while the latter is entrapped in the box **58** and for this purpose I provide a vertically disposed cylinder **59**, the piston rod of which is formed at its lower end with a head **60** having a bayonet slot to slidably receive the flanged or grooved upper end of the rolling mandrel **44** as the latter moves into the slot in the top wall of the box **58**, it being understood that during such entry of the mandrel **44** the head **60** will be down in contact with the top wall of the box **58**. Suitable means, not shown, is provided to prevent

the piston rod and head **60** from rotating so that the open entry end of the bayonet slot in this head will always be oriented to the left as viewed in Figure 13 to receive the approaching upper end of the mandrel **44**. Fluid energization of cylinder **59** forcibly withdraws the mandrel **44** from the rolled work piece **61** and the latter now discharges vertically through an opening **62** formed in the track **56**.

For the subsequent handling of the mandrels **44** I provide a transfer turntable **63** and other apparatus which is shown in Figures 1 and 14 through 17. Thus, the turntable **63** is essentially an elongated horizontally-disposed support pivotally mounted for swinging movement about a vertically extending axis which is centrally disposed and mounted at each end of such support is a pair of tongs **64** (**65**). Tongs **64** and **65** have a common separating means in the form of an air or hydraulic cylinder **66** housed within the body of the support and the arrangement is such that upon actuation of the cylinders **66** in one direction tongs **64** are open while tongs **65** are closed and upon actuation of cylinder **66** in the opposite direction the condition of the two pair of tongs is reversed. As shown in Figures 1, 13 and 14 the turntable **63** is so dimensioned and positioned that one of the tongs thereof is operative to grasp a rolling mandrel immediately upon its withdrawal from the stripper box **58** while the other tongs drops a previously stripped mandrel into a cooling tank shown at **67**. Thus, the elevation of the turntable **63** is such as to position the tongs **64**, **65** vertically intermediate the top of the stripper box **56** and the uppermost position of the bayonet head **60**. Of course, during the stressing operation the particular tongs which is thus so intermediately positioned is widely open to allow passage of the stripper head **60** but upon this head reaching its uppermost position a suitable limit switch, not shown, operates to reverse the fluid energization of cylinder **66** whereby this adjacent tongs closes tightly onto the newly stripped mandrel. Means, such as motor **67** and appropriate initiating and control devices, not shown, is employed to rotate the turntable **63** through 180° in each cycle of operation. The direction of rotation of the turntable **63** is such that the mandrel being removed from the stripper station is moved out of the head **60** in the opposite direction from the entering direction.

At the cooling tank **64** the mandrels are guided in their vertical descent by a tube **68** (Figures 14 and 16) into vertical position at one end of the tank where they are engaged on their sides by a pusher **69** operated by an air cylinder **70**. Extending inwardly from the side walls of the tank is a pair of spaced parallel guide steps **71** between which pass the necks of the mandrels **44** so that the mandrels retain their vertical positions during their traverse through the tank. At the discharge end of the tank the necks of the mandrels enter through-slots formed in the lower wall of a box-like head **72** carried by the lower end of the piston rod **73** of cylinder **74**.

Fluid energization of cylinder **74** raises head **72** and a mandrel suspended therefrom to an upper position wherein the elevated mandrel may be gripped by tongs **75** which are mounted on a carrier **76** and arranged to be opened and closed by an air cylinder **77**. Carrier **76** is supported on the cantilevered outer ends of a pair of spaced parallel rods **78** which are slidable in fixed supports **79** and which are arranged to be moved back and forth by an air or hydraulic cylinder **80** which is fixed at one end to certain of these fixed supports and has its piston rod connected to a cross head **80'** rigidly interconnecting the opposite ends of the rods. During movement of the carrier **76** to the right, as viewed in Figure 17, the tongs **75** are open to receive an elevated mandrel and upon the latter coming into proper position cylinder **77** is energized to close the tongs onto the mandrel after which cylinder **80** is energized to move the tongs and mandrel to the left into position Q which is immediately above the location of the

pierced billet at the discharge station of the press. In this position the mandrel is in alignment for engagement by the piston rod of the cylinder **43** (see Figure 11) whereby the mandrel may be moved downwardly into the pierced billet and the billet and mandrel ejected from the die ring **17** as initially explained above.

I claim:

1. In apparatus for producing shell casings and the like the combination of a forging press having a pair of vertically disposed tie rods, a die turret rotatably mounted on one of said rods and mounting a plurality of circumferentially spaced ring-like dies, a turret rotatably mounted on the other of said rods and slideably mounting a plurality of piercing dies, crossheads at the top and bottom of said rods each mounting a centrally disposed cylinder, rams in said cylinders, an anvil slideably mounted on said rods and adapted to be moved upwardly by the bottom ram to close off the bottom of one of said ring-like dies when the latter is indexed to central position in the press, said upper ram being adapted to engage and move downwardly one of said piercing dies when the same is indexed to central position in the press, means to load elongated billets vertically into said ring-like dies at a station away from said central position, and means to eject pierced and forged billets downwardly through the open bottom ends of said ring-like dies at another station away from said central position.

2. In apparatus for producing shell casings and the like wherein a forging press is utilized to pierce and form the billets preparatory to rolling the combination of a rotary die holding having at least three circumferentially spaced female dies for the containment of billets to thus provide a loading station, a working station in the press, and a discharge station; a horizontally-disposed conveyor for the transfer of heated elongated billets longitudinally and in succession to said loading station; a downwardly and outwardly disposed yoke on said press above said loading station, and a pair of jaws pivotally mounted in said yoke for rotation about a horizontal axis, means to hold said jaws with an opening therebetween extending horizontally to receive a horizontally disposed billet from said conveyor, means to rotate said jaws so that said opening extends vertically and above the die positioned at the loading station whereby upon release of said jaws said billet will fall vertically into said die.

3. Apparatus according to claim 2 further characterized in that said pair of jaws is carried by a member which is pivotally mounted in said yoke, power means on said member to move said jaws forcibly together, and said jaws being formed to impart an initial roundness to said billets by the squeezing action thereof.

4. In a forging press the combination of a base having a centrally disposed and upwardly opening cylinder therein, a pair of vertically disposed but spaced tie rods having their lower ends anchored in said base, a cross-head secured to the upper ends of said tie rods and having a centrally disposed but downwardly opening cylinder therein, a turret-type of female die holder rotatably mounted on one of said rods, a cross-head slideable on said rods intermediate said holder and said base and carrying a centrally disposed anvil adapted to close off open bottom ends of the female dies when the latter are indexed to working position centrally in the press, a ram in said first mentioned cylinder for raising and lowering said last mentioned crosshead, a crosshead slideably mounted on said rods above said holder, a turret-type of male die holder rotatably mounted on the last mentioned crosshead for rotation about the axis of the other of said rods, a ram for the cylinder in the crosshead at the upper ends of the rods and connected to the last mentioned slideable crosshead to raise and lower the same, said last mentioned ram having a downward extension to bear directly against the particular male die which is indexed to working position centrally in the press, the arrangement being such that the force loading of the press during a forging operation is centrally disposed and symmetrical with relation to said rods.

5. Apparatus according to claim 4 further including a stripper plate secured to and spanning said rods intermediate said turret-type of holders, the means securing said stripper plate being operative to prevent upward sliding movement of the plate along said rods, and a centrally disposed aperture in said plate to allow passage of a male die, the arrangement being such that upon upward retraction of said second mentioned holder and said male die the pierced billet will remain seated in its female die in said first mentioned holder.

6. In a press for producing pierced billets and the like, in combination, a pair of vertically disposed tie rods, a first turret rotatably mounted on one of said rods, a plurality of circumferentially spaced female dies carried by said first turret, a second turret rotatably mounted on the other of said rods, a plurality of circumferentially spaced male dies carried by said second turret, said turrets having respective die stations overlapping with the axes of the respective male and female dies at said overlapping stations generally coinciding with the axis of said press, means for loading a billet into a female die at a station of said first turret away from said overlapping station, means for producing relative movement between said dies to press said male die into said billet in said female die at said overlapping station, means for separating said male die at said overlapping station from said billet and its surrounding female die, and means for ejecting said pierced billet at a station of said first turret away from said overlapping station.

7. In a press for producing pierced billets and the like, in combination, a pair of vertically disposed tie rods, a first turret rotatably mounted on one of said rods, a plurality of circumferentially spaced female dies carried by said first turret, said female dies having generally straight interior walls, a second turret rotatably mounted on the other of said rods, a plurality of circumferentially spaced male dies carried by said second turret, said turrets each having a central overlapping die station with the axes of the respective male and female dies at said overlapping station generally coinciding with the axis of said press, said male die being above said female die, means for loading a billet into a female die at a station of said first turret away from said overlapping station, means for producing relative movement between said turrets, a closure for the bottom of a female die at said overlapping station, a ram movable along the axis of said press to press said male die downwardly into said billet in said female die at said overlapping station, means for separating said male die at said overlapping station from said billet and its surrounding female die, and means for ejecting said pierced billet downwardly through its female die at a station of said first turret away from said overlapping station.

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